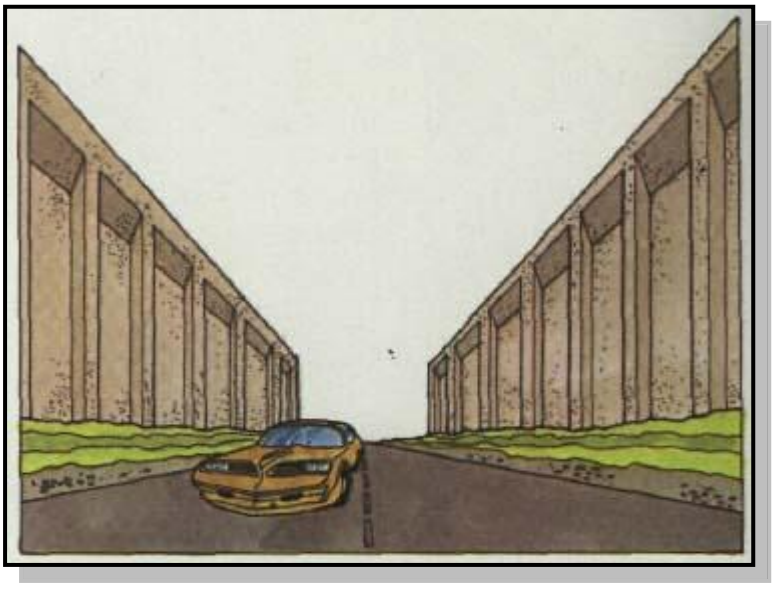
James City County Sound Wall Design Guidelines

Highway noise barriers tend to dominate their surroundings since they must be placed close to the roadway, frequently extend for thousands of feet along the right-of-way, and often must be over eight feet in height to be effective. The potential for adverse impact should be minimized by utilizing design principles in the planning process, and by a thorough analysis of the site and existing conditions prior to design.

James City County has created these guidelines in order to work closely with the Virginia Department of Transportation (VDOT) to establish a set of consistent specifications expected for building sound walls within the County. It is the County's intention to streamline the procedure, ensure that sound walls within the County are both effective sound barriers and aesthetically pleasing.

Principles of Line and Form

The line and form of a noise barrier are its two most dominant features. The line of a noise barrier is expressed as its outline in plan view, and as its top surface in elevation. Both are equally important visually to the motorist and highway neighbor. Long straight lines are monotonous and make a wall seem longer than it actually is. The effect on the motorist is that of being enclosed, as in a tunnel. High walls adjacent to a roadway tend to create anxiety in motorists - they slow down and unconsciously attempt to move away from the wall. The effect of a high, straight wall on the highway neighbor is that of forced enclosure. Corresponding negative attitudes about the wall may develop particularly if the wall is bare and without visual interest. Therefore the designer should consider the line of the noise barrier as a possible adverse visual impact and examine alternatives for reducing this impact.



The line of a noise barrier should reflect similar lines of the surrounding environment. In rolling terrain, a straight line seems out of place and attention is drawn to that line. However, in flat terrain, where the horizon is visible as a straight line and the highway is straight, a straight line in a noise wall may be appropriate. A uniform top line of a wall would be appropriate in this case.

Figure 1-Tunnel effect of high walls

Where horizontal lines are evident in nearby structures, a horizontal line would be suitable in a noise wall. In a situation where the horizon is composed of alternating heights of buildings, an appropriate top line of a wall might vary in height as a reflection of the lines on the horizon.

Horizontal lines within the wall tend to make an object appear longer and lower. Vertical lines with in the wall have the effect of added height and tend to make an object appear narrower. Sound walls tend to be long and high; therefore, both horizontal and vertical lines, if used improperly, may emphasize undesirable features in a wall. Horizontal lines are difficult to utilize in rolling terrain and should be avoided in this situation. Vertical lines should be avoided on extremely high walls. Combinations of horizontal and vertical lines may be effective where extreme height is a visual problem. The introduction of a vertical element is the key to proper visual balance. A vertical line should be distinct and massive enough to register as such. Noise barriers, as strong horizontals, need a correspondingly strong vertical for asymmetrical balance. Strong verticals may be designed into a wall through the use of pilasters, which further serve as structural support.

Plantings can be effective means of emphasizing vertical lines in a noise barrier. Columnar trees can be used even where space is limited. The use of vertical lines in the form of trees or through wall design should be as an accent, a balance with the horizontal. One should not replace predominantly horizontal with predominantly vertical lines. Care should be taken to achieve a balance between the vertical and the horizontal lines in noise barriers.

Sound walls which begin and end abruptly and consist of straight, unbroken lines often appear to be discordant elements in the landscape. These should appear to be a part of the highway scene wherever possible, and not give the impression of being placed as an afterthought. Walls should begin and end in a natural transition from ground plane to the desired height. Where space allows, the best transition is through the use of an earth berm or by tying the wall into the natural hillside. The line of the wall then appears to originate from the landscape.

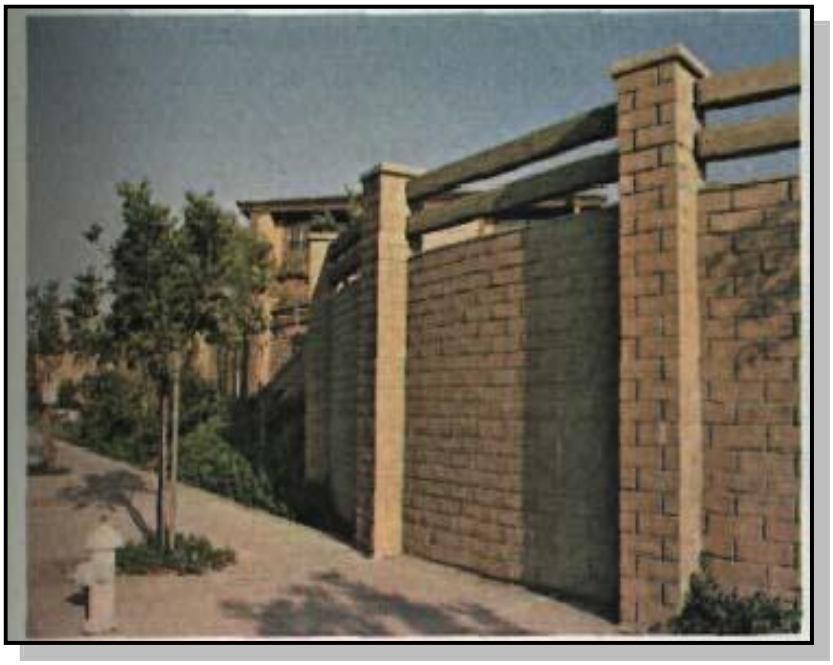
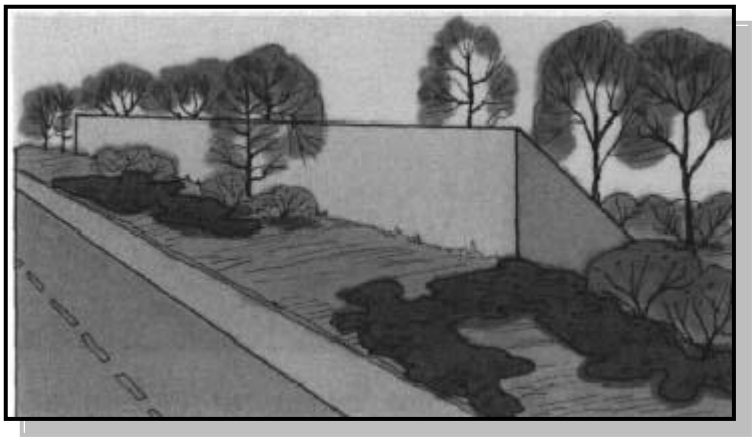


Figure 2-Pilasters serve as vertical elements in the wall

This may further be avoided by either a gradual tapering of the wall to a point near the ground or by stepping the wall in even increments until a point is reached where the wall is no longer visually dominant. Where possible, walls should tie into existing structures such as bridge abutments, retaining walls, etc., in order to achieve continuity of line.



The line of a wall may vary in plan view in order to reduce the straight line effect. A series of jogs in a wall serve to break the monotony of a straight wall and create pockets which may be used for plantings.

Figure 3-Lines appear to be part of the landscape

The breaks may further be used as transition points for change in texture, color, or wall height. The line may vary in a curvilinear manner to produce a serpentine wall, which likewise creates visual interest in a wall, and provides the opportunity for planting pockets.

Plantings also may be used to break an undesirable line in a wall. Trees in front of a wall soften the harsh lines; the eye perceives the form and outline of the trees as one with the line of the wall. Vines allowed to grow over a wall will likewise soften an otherwise highly visible hard line. Tree groupings should alternate on both sides of a wall - the viewer becomes less aware of the line of the wall since it becomes part of a composition of forms, rather than a separate element.

Figure 4- Plant Materials to help soften the wall

Guidelines for the use of Line and Form

The lines and form designed into sound walls within James City County should mimic the lines and forms in the natural surrounding. If the terrain is rolling hills, then the lines and form of the wall should have horizontal and vertical elements and if the terrain is primarily flat then the design should incorporate predominantly horizontal lines.

Principles of Color

Harmonious colors tend to soothe, contrasting colors tend to attract the eye, and clashing colors irritate. A sound wall placed along the highway may evoke similar responses in the motorist, depending upon the colors chosen. The motorist should be directed past a barrier with as little visual disruption as possible, because the primary attention of the driver should be on the road ahead and local traffic conditions. The colors chosen for the barrier should reflect and harmonize with the predominant colors of the highway environment in which it is placed. They should not attempt to match the color of trees, grass, or shrubbery because they are not related to such natural features by form. Rather, harmonious colors should be utilized. When used on structures in the landscape, earth colors (browns and grays of various tones) help to blend the structures into their environment. Structures which utilize these colors seem to belong to the landscape - they appear to be part of the landscape, rather than an unharmonious element added as an afterthought.

Color interest and variety may be achieved through the use of plant materials instead of by direct application on barriers. The added advantage of plantings is in seasonal variation of color. Plants which change color in spring, summer, and fall, when used in conjunction with a barrier, will impart a seasonal variation in the barrier as well. In most cases, the barrier should be of a neutral color which blends with the environment, rather than attracting attention.

Guidelines for the use of Color

The color of sound walls within James City County should be a natural earth tone that blends into the color of the existing terrain but does not match the color of plant materials that are to be placed in front of the wall. The wall should be a neutral color that will help the plant materials placed in front stand out. Walls that are over ten feet in height and one thousand feet in length should incorporate two colors to break up monotony and give the wall some added interest. Incorporating more than two colors should only be applied to walls that are extremely

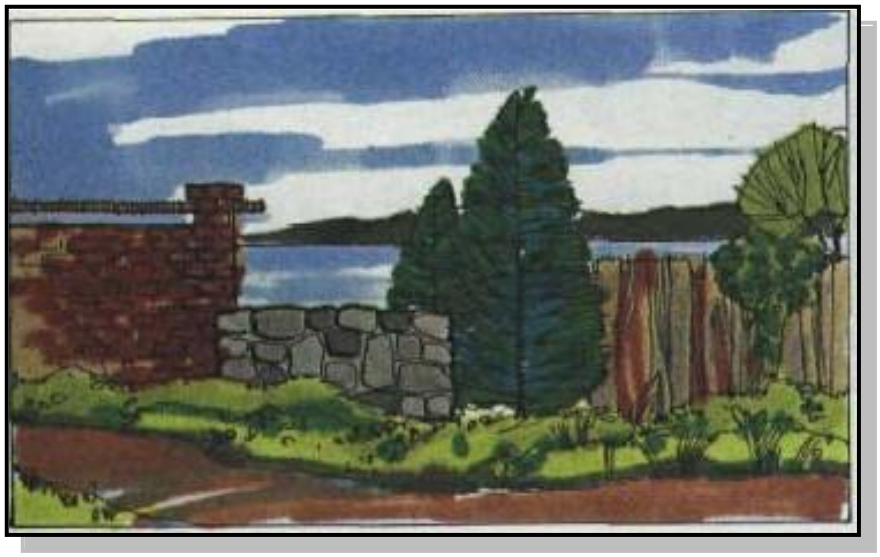


Figure 5-Tone colors blend the walls with the landscape

large, and is not recommended for the smaller applications found in James City County.

The color of the plant materials selected to go in front of the walls should compliment but not match the color of the wall. The color of the plants should vary so as the motorist drives along it creates a progression of colors.

Figure 6-A mixture of texture adds interest to the wall

Texture in Walls

The use of texture on sound walls helps to create a pleasant variety for both the motorist and the resident. A motorist views a barrier at speeds up to 55 mph and has little opportunity to examine details. Most details flash by in a blur. Walls present good opportunities for textural treatment. Texture should be used wherever possible for maximum visual potential. Cast-in-place and precast concrete has flexibility for variations in surface texture. Texture may be created during the casting process or applied afterward.

Exposed aggregate finishes create interesting textures, particularly where coarse aggregate is used in the mix. This is also effective when used alternately with other textures. The added advantage of exposed aggregate is low light-reflectance which helps to reduce the visual impact of the barrier. Wall colors can be varied, depending on the color of the aggregate.

Shadows created in the forming process help to create texture and break up the visual monotony of a plain wall. These may be created through the use of rustication strips placed in the forms, or by variation in the form itself. Horizontal overhangs or vertical jogs in a wall should be deep enough to cast a discernable shadow visible from a distance.

Perhaps the most visually effective method of creating texture in concrete is by using a combination of methods and textures, particularly for long and high barrier walls. Interesting effects may be obtained by varying the texture of a long section of wall; however, textures should be compatible and similar in contrast. Rarely should more than two textures be used on the same wall; the designer should avoid alternating textures in even, repetitive patterns. By varying the textures of the wall and textures of the plant materials the designer can create interest and break up monotony. Sound walls within James City County should be designed so that the texture on the motorist side of the wall is

a course texture that can be seen at high speeds and the residential side of the walls should have a fine texture that is easily seen by slow moving pedestrians.

The texture between the plants and the wall should differ slightly and offer some contrast so the plants will stand out and not blend into the wall. Applying too many textures to the same wall can result in cluttered appearance that is not easily ignored by passing motorists. James City County does not recommend using more than two textures on sound walls and using even, repetitive treatment of textures on long walls.

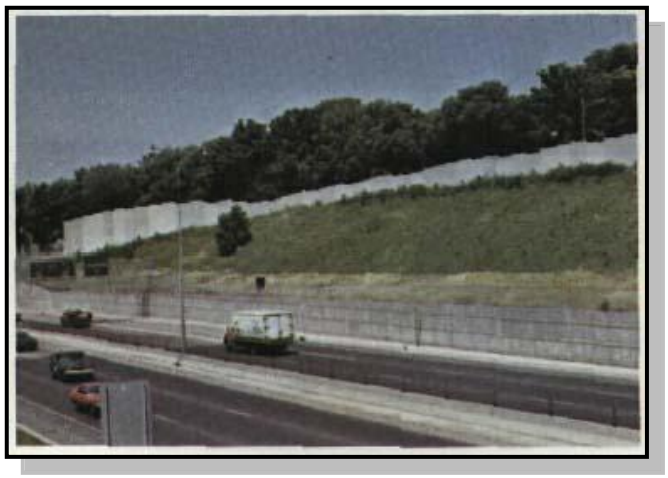
Creating Texture with Plants

Each type of noise barrier presents the opportunity for textural variation, which will aid in public acceptance of the barrier. Textural variation in earth berms can, perhaps, be best accomplished through the use of plantings. Plantings on the highway side should be arranged in large groupings or masses of a single plant type, size, or color. Plants with large leaves represent the coarsest textures and should be used "en masse" where this texture is desired. Massing should be in irregular, free-form patterns of varying size, rather than equally spaced and repetitive. There should be a contrast between the texture of the wall and the texture of the plants.

Principles of Contrast

A noise barrier may contrast with its surroundings by its line, form, texture, or color. In residential areas, the barrier should be unobtrusive and, therefore, low in contrast. On the highway side, a barrier should blend rather than contrast with the surroundings since high contrast is distracting to the driver. Plantings can either increase or decrease contrast of a noise barrier. Plantings that are similar in form, color and texture to other native plants present in the area help to reduce the contrast of a noise barrier. Plantings that are unique in form or color or that are dissimilar to native plants in an area tend to increase contrast. Likewise, to decrease contrast, plantings should be arranged in informal, natural groupings rather than in obvious, equally spaced, patterns.

Contrast may also be increased or decreased via color of the barrier itself. Where high contrast is desired, lighter colors or wall graphics may be used effectively. Darker, earth colors tend to reduce contrast. The designer should examine the site and surroundings in order to determine the predominant natural colors and choose similar or harmonious colors for the noise barrier where low contrast is desired.



Guidelines for the use of Contrast

The design of sound walls in James City County should incorporate construction materials and plants that contrast slightly to their surroundings, helping to make the wall seem to be part of the landscape while contrasting enough to make the planting in front of the walls stand out. Line, form, color, and texture all contribute to contrast and each should be considered when choosing construction materials and plants.

Figure 7-Less contrast would have helped blend this wall into its surrounding

Principles of Sequence

Travel on a highway is a continuous, ever-changing experience of vision and motion. A planned sequence of events creates interest for the moving observer; a static event creates monotony. A sound wall can create a pleasant visual experience for the motorist through a progression or planned sequence. The transition from ground plane to maximum barrier height should be a sequence of gradually increasing steps or a continuous sweeping line to help create this effect. A sequential experience may be created through the arrangement of plantings, by a gradual increase in height of trees and shrubs. Plant masses can be used to define a space by becoming, in effect, the walls of the enclosure. Varying the position of these masses with respect to the road creates a succession of confined and relatively open spaces. This pleasant feeling of motion and rhythm imparted to the moving observer tends to dramatize the experience of passing through the space.

Guidelines for Sequencing

A sense of sequencing should be an element of all sound walls within James City County. Sequencing should be designed into the wall and the landscaping. Longer sound walls should have sequencing in the height of the wall and create areas that change the distance from the wall to the road. Indentations in the wall can create attractive niches that help break up the long expanse of wall and add a series of interesting spaces that change as the motorist moves by. Such indentations enable the designer to incorporate sequenced changes to the landscape and wall. Landscaping should be an informal design than changes as you progress along the wall. Groups of trees and shrubs should be utilized, repetitive treatments should be avoided. Treatment should change as the motorist moves along to pull the eye along the progression.

Principles of Dominance

A dominant element attracts attention to itself in a visual scene. A noise barrier should not be the dominant feature along a highway. Dominance of a single element can be reduced through the introduction of other dominant elements which balance each other in the visual

composition. Plantings in front of a barrier help to reduce visual dominance, particularly if the plantings are native varieties commonly found or present in an area. Color can also affect dominance. Brighter, contrasting colors make an object more dominant. Subdued, harmonious colors, similar to surrounding colors in intensity, tend to make an object less dominant. Wall design can also affect dominance of a noise barrier. Straight, high walls adjacent to the roadway appear imposing, an encroachment upon the space. Walls which step back in some way relieve this tight constricted feeling, and become less of a dominant element in the highway environment. Similar patterns of dominance occur on the residential side of barriers, with equally similar effects upon the resident.

Guidelines for Dominance

Sound wall design with in James City County should incorporate construction materials and plantings that reduce the visual dominance of the wall and emphasize the natural terrain and vegetation. The wall can appear to be part of the natural landscape by starting the placement of the wall from a wood line or berm and having the height increase as you progress and then decrease as you come to the end. The configuration of the wall should mimic the natural terrain and the landscaping should mimic the natural vegetation.

Principles of Landscaping

Figure 8 Informal landscape design

The landscape treatment of sound walls should use plants that are similar to existing vegetation in the area and planted in an informal design that makes the wall appear to be part of the natural landscape. Repetitive uniform plantings should be avoided. Groups of plants placed in an informal pattern that pulls the eye along as you progress is preferred.

Guidelines for Landscaping

Sound walls built within James City County should always have landscaping installed in front and when possible have tall existing vegetation behind the wall. The County is aware that it is not always possible for enough right of way area to be provided for landscaping. However every effort should be made to utilize as much area for landscaping that is practical. The landscape design should incorporate the design principles of line, form, texture color, dominance, sequencing, and dominance discussed above.

Construction Materials

There are a wide range of construction materials available for sound wall construction, ranging from wood, steel, rock, concrete, concrete block, and precast. All of these materials offer their own aesthetic and sound absorbing or sound reflecting properties. Typically the precast systems offer the most flexibility in design and are most often the most economical choice.

Figure 9 Pre cast concrete systems are economical and attractive and offer a wide variety of styles

Construction Material Guidelines

All sound walls within James City County should utilize the most aesthetically pleasing products that offer suitable sound absorbing properties, and are readily available on the market today. Since sound walls are primary funded by the Federal Government, efforts to keep cost below the $30,000.00 per effected resident standard should be made. James City County would consider any construction material that can provide the proper noise abatement and costs within the proposed budget. Aesthetics should be the primary emphasis when choosing the type of construction material used, with cost also taken into consideration.

Conclusion

The intent of these guidelines is to enable James City County to work closely with VDOT through the design process of sound walls. These guidelines will be made available to VDOT so the County's desired treatment of sound walls can be known before the design process begins. Once the design process begins the County shall be active in the public meetings portion. VDOT advertises the public meetings in local newspapers and sends out notices to the effected property owners. The meetings are typically held at local schools. It is the County's intent to have a representative at each of these meetings to advocate the design principles contained in these guidelines. The guidelines are intended to enhance the operation of these meetings by making the County's preferences known ahead of time and to ensure that the design of sound walls with in the county are designed to be efficient sound mitigation facilities that are cost effective and aesthetically pleasing. The following bullet points summarize the James City County's expectations for the design and construction of sound walls.

- The line and form of sounds walls should mimic the line and form found in the natural landscape making the wall appear to belong as an element of the natural topography.

- Colors in sound walls should be earth tones that blend into the natural surroundings, and no more than two colors should be used.

- Textures used in sound walls should be compatible similar in contrast. Rarely should more than two textures be used on the same wall. The textures of plant materials should contrast slightly with the texture of the wall to make the plants stand out.

- Sound walls should contrast with their surroundings only slightly so the wall blends into the natural landscape. Some contrast between the wall and plant materials should exist to make the plants stand out but not enough to be distracting.

- Sound walls should be designed to create a progression of line, form, color, texture and contrast known as sequencing. Sequencing should add changing interest to the wall and pull the eye along as one progress along the wall.

- Sound walls within James City County should never dominate their surroundings. Sound walls should be designed to reduce the visual dominance of the wall and emphasize the natural terrain and vegetation.

- All sound walls in James City County should have landscaping install in front when possible. Every effort should be made to provide a planting area. The landscape design should incorporate elements of line, form, color, texture, and contrast to reduce the visual dominance of the wall and make it blend into the natural surroundings. Landscaping should soften the wall and create a progression that pulls the eye along as one proceeds.

- Construction materials should be selected based on their aesthetic value and sound absorbing properties. The cost of materials should also be considered and an effort to keep cost below the proposed budget should be made.